

CLAIMS

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$$R^1-O-X^1-$$
$$\left[\text{---O---C(=O)---CH=CH---C(=O)---O---X}^2 \text{---} \right]$$

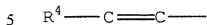
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R2C(R3)=CCCC

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(wherein R^2 and R^3 each independently represents hydrogen atom or an alkyl group having from 1 to 5 carbon atoms);

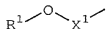
Formula (4)



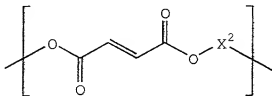
(wherein R^4 represents hydrogen atom or an alkyl group having from 1 to 11 carbon atoms).

2. A fumarate derivative having at least one group
10 represented by formula (1) as the terminal groups and having two or more groups represented by formula (2) and/or formula (5) as a repeating unit:

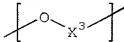
Formula (1)



- 15 Formula (2)



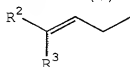
Formula (5)



- (wherein in formula (1), each R^1 independently
20 represents formula (3) or (4), and in formulae (1), (2) and (5), X^1 , X^2 and X^3 each independently represents an organic residue derived from a polyhydric alcohol having from 2 to 6 hydroxyl groups and having from 2 to

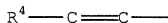
30 carbon atoms, provided that X^1 , X^2 and X^3 may be ester-bonded and/or ether-bonded to have a branched structure having a group represented by formula (1) as the terminal groups and having a group represented by formula (2) and/or formula (5) as a repeating unit);

Formula (3)



(wherein R^2 and R^3 each independently represents hydrogen atom or an alkyl group having from 1 to 5 carbon atoms);

Formula (4)



(wherein R^4 represents hydrogen atom or an alkyl group having from 1 to 11 carbon atoms).

3. The fumarate derivative as claimed in claim 1 or 2, wherein the number of repetitions of the repeating unit represented by formula (2) is any one in the range from 2 to 10.

4. The fumarate derivative as claimed in claim 2 or 3, wherein the number of repetitions of the repeating unit represented by formula (5) is any one in the range from 2 to 5.

5. The fumarate derivative as claimed in any one of claims 1 to 4, wherein 80% or more of R^1 in formula (1) is formula (4).

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6. The fumarate derivative as claimed in any one of claims 1 to 5, wherein R^4 in formula (4) is any one selected from the group consisting of hydrogen atom, a methyl group, an ethyl group, an n-propyl group and an isopropyl group.

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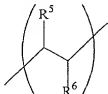
7. The fumarate derivative as claimed in any one of claims 1 to 6, wherein X^1 , X^2 and X^3 in formulae (1), (2) and (5) each independently is an organic residue derived from at least one alcohol selected from the group consisting of an alkylene diol, an alicyclic diol and an aromatic diol.

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8. The fumarate derivative as claimed in any one of claims 1 to 7, wherein the organic residue as claimed in claim 7 is represented by formula (6).

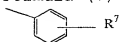
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Formula (6)



(wherein R^5 and R^6 each independently represents hydrogen atom or formula(7));

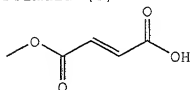
Formula (7)



- 5 (wherein R^7 represents hydrogen atom or an alkyl group having from 1 to 3 carbon atoms).

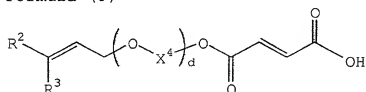
9. The fumarate derivative as claimed in any one of claims 1 to 8, wherein at least one terminal group is a
10 group represented by formula (8):

Formula (8)



10. The fumarate derivative, which is represented by
15 formula (9):

Formula (9)

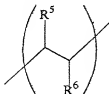


- (wherein each X^4 , which is present in the number of d in formula (9), independently represents an alkylene
20 group or a cycloalkylene group having from 5 to 12 carbon atoms, d represents an integer of 1 to 5, and R^2

and R³ each independently represents hydrogen atom or an alkyl group having from 1 to 5 carbon atoms).

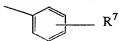
11. The fumarate derivative as claimed in claim 10,
5 wherein X⁴ in formula (9) is an alkylene group represented in formula (6).

Formula (6)



- (wherein R⁵ and R⁶ each independently represents
10 hydrogen atom or formula(7));

Formula (7)



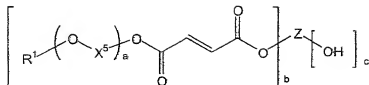
- (wherein R⁷ represents hydrogen atom or an alkyl
group having from 1 to 3 carbon atoms).

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12. The fumarate derivative as claimed in any one of claims 1 to 9, wherein at least one terminal group is a hydroxyl group.

- 20 13. The fumarate derivative, which is represented by formula (10):

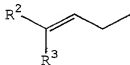
Formula (10)

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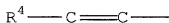
(wherein Z represents an organic residue derived from a tri-, tetra-, penta- or hexa-hydric alcohol, R^1 independently represents formula (3) or formula (4), each X^5 , which is present in the number of a in formula (10), independently represents an alkylene group or a cycloalkylene group having from 5 to 12 carbon atoms, a represents an integer of 1 to 5, b represents an integer of 1 to 6, c represents an integer of 0 to 5, and b+c is from 3 to 6);

Formula (3)



(wherein R^2 and R^3 each independently represents hydrogen atom or an alkyl group having from 1 to 5 carbon atoms);

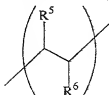
Formula (4)



(wherein R^4 represents hydrogen atom or an alkyl group having from 1 to 11 carbon atoms).

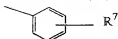
14. The fumarate derivative as claimed in claim 13, wherein X^5 in formula (10) is an alkylene group represented in formula (6).

Formula (6)



(wherein R^5 and R^6 each independently represents hydrogen atom or formula(7));

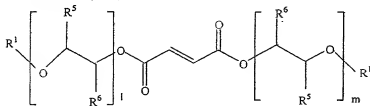
Formula (7)



10 (wherein R^7 represents hydrogen atom or an alkyl group having from 1 to 3 carbon atoms).

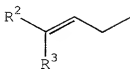
15. The fumarate derivative, which is represented by formula (11):

Formula (11)



(wherein, R^1 independently represents formula (3) or formula (4), and l and m each independently represents an integer of 1 to 5);

20 Formula (3)



(wherein R^2 and R^3 each independently represents hydrogen atom or an alkyl group having from 1 to 5 carbon atoms);

5 Formula (4)

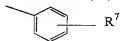


(wherein R^4 represents hydrogen atom or an alkyl group having from 1 to 11 carbon atoms).

(wherein R^5 and R^6 each independently represents

10 hydrogen atom or formula (7));

Formula (7)



(wherein R^7 represents hydrogen atom or an alkyl group having from 1 to 3 carbon atoms).

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16. A method for producing a fumarate derivative as claimed in any one of claims 1 to 9 and claim 12, comprising reacting a fumarate derivative having at least one formula (8) in the terminal groups and having two or more groups represented by formula (2) as a repeating unit with a polyhydric alcohol having from 2 to 6 hydroxyl groups and having from 2 to 30 carbon atoms in the presence of a catalyst.

17. A method for producing a fumarate derivative as claimed in claim 13 or 14, comprising reacting a fumarate derivative having at least one group
- 5 represented by formula (8) in the terminal groups with a polyhydric alcohol having from 2 to 6 hydroxyl groups and having from 2 to 30 carbon atoms in the presence of a catalyst.
- 10 18. A method for producing a fumarate derivative as claimed in any one of claims 1 to 9 and claim 12, comprising reacting a fumarate derivative having at least one group represented by formula (8) in the terminal groups and having two or more groups
- 15 represented by formula (2) as a repeating unit with a polyhydric alcohol having from 2 to 6 hydroxyl groups and having from 2 to 30 carbon atoms in the presence of a condensing agent and a base.
- 20 19. A method for producing a fumarate derivative as claimed in claim 13 or 14, comprising reacting a fumarate derivative having at least one group represented by formula (8) in the terminal groups with a polyhydric alcohol having from 2 to 6 hydroxyl groups

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and having from 2 to 30 carbon atoms in the presence of a condensing agent and a base.

20. A method for producing a fumarate derivative as
5 claimed in claims 18 and 19, wherein the condensing agent is sulfonyl chloride.

21. The method for producing a fumarate derivative as
10 claimed in any one of claims 16 to 20, wherein the polyhydric alcohol having from 2 to 6 hydroxyl groups and having from 2 to 30 carbon atoms is at least one selected from the group consisting of trimethylolpropane, trimethylolethane, pentaerythritol, ditrimethylolpropane, dipentaerythritol and adducts
15 thereof with an ethylene oxide or a propylene oxide.

22. A method for producing a fumarate derivative having formula (4) in the terminal groups, comprising isomerizing terminal groups of a fumarate derivative
20 having formula (3) as the terminal groups in the presence of a catalyst to convert said terminal groups into formula (4).

23. The method for producing a fumarate derivative
25 having formula (4) in the terminal groups as claimed in

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claim 22, wherein the fumarate derivative having formula (3) as the terminal groups is the fumarate derivative described in any one of claims 1 to 15.

- 5 24. The method for producing a fumarate derivative having formula (4) in the terminal groups as claimed in claim 22 or 23, wherein 80% or more of the fumarate derivative having formula (3) as the terminal groups is converted into formula (4) by the isomerization
10 reaction.

25. The method for producing a fumarate derivative having formula (4) in the terminal groups as claimed in claim 22 or 23, wherein the catalyst used for the
15 isomerization reaction is a catalyst containing at least one of palladium, rhodium and ruthenium.

26. A polymerizable composition comprising the fumarate derivative as claimed in any one of claims 1
20 to 15.

27. The polymerizable composition as claimed in claim 26, which comprises:

from 1 to 99% by mass of the fumarate derivative
25 described in any one of claims 1 to 15, and

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from 1 to 99% by mass of at least one compound selected from the group consisting of an unsaturated polyester, an oligomer having (meth)acrylate group and a radical polymerizable monomer.

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28. A polymerizable composition comprising:

100 parts by mass of the polymerizable composition described in claim 26 or 27, and

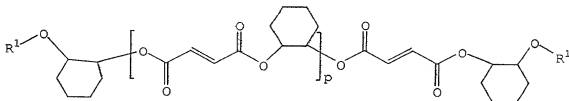
from 0.01 to 15 parts by mass of a radical
10 polymerization initiator.

29. A cured product obtained by curing the polymerizable composition as claimed in any one of claims 26 to 28.

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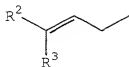
30. The fumarate derivative, which is represented by formula (25):

Formula (25)



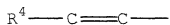
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(wherein, R^1 independently represents formula (3) or formula (4), and p represents an integer of 1 to 9);
Formula (3)



(wherein R^2 and R^3 each independently represents hydrogen atom or an alkyl group having from 1 to 5 carbon atoms);

5 Formula (4)



(wherein R^4 represents hydrogen atom or an alkyl group having from 1 to 11 carbon atoms).

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